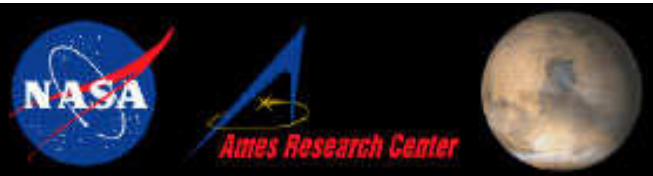

Mars Climate Modeling Center

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NASA Ames Research Center

Space Science and Astrobiology Division

Outline

- What is meant by a Mars Climate Modeling Center (MCMC)?
- Why is an MCMC a good idea?
- What processes are underway?
- White Paper
- Next steps
- Summary

Proposed MCMC

- In support of NASA's Mars Exploration Program (MEP), a national center for Mars climate modeling would be established that provides
  - dedicated mission support for both current and those future planned
  - an efficient Mars climate resource for the science and mission engineering communities

An MCMC is a good idea

- For NASA — to serve mission design/testing needs on a dedicated basis
  - MSL atmospheric support related to entry, descent and landing (EDL) activities
  - MSL site selection: environmental extremes/meteorological characterization
  - MAVEN upper-atmosphere context during A/B
  - MAVEN upper-atmosphere characterization during planned "deep dips" with periapsis at $\mathcal{O}$(125 km)

An MCMC is a good idea

- For the Community — a truly cooperative and service-based US modeling effort for efficiency related to Mars climate science
  - global climate modeling (3D) is an ambitious enterprise
  - provide a framework for open access to a state-of-the-art Mars global climate model and its complete physics packages
    - web access & instructions
    - code documentation
    - standarized output
    - visualization tools
    - focused training & workshops
  - built-in flexibility — adaptable to new applications and problems

An MCMC is a good idea

- For the Community (cont.)
  - not going to impact R&A programs ($$) — scientific investigations can leverage the MCMC infrastructure and capabilities
- For NASA & the Community
  - generate a Mars Climate database
    - based on a state-of-the-art model, plus available/relevant observations
    - user-friendly, web-based interface

MCMC User Base

User Type	*Needs/Expectations*
Expert	new packages, modules, generalized Mars climate models, generalized diagnostic packages
Intermediate	observations, retrievals, data reduction, standard Mars climate models and diagnostics
Non-Expert	standardized databases and climatologies
All	full documentation, userguides, tutorials, workshops, Mars climate database

MCMC Mission

- To provide a Mars atmospheric science and global climate modeling resource for the Nation's Mars Exploration Program
- To foster community interaction and access on endeavors related to Mars atmospheric science and climate research
- To understand the structure and variability of Mars' atmosphere and climate on the basis of physical systems and processes
- To promote the exchange of atmospheric and climate science knowledge related to the exploration of Mars

Processes Underway

- Community surveys & correspondences with NASA PSD
- Exploratory workshop on MCMC convened (Fall 2008)
  - inputs and interactions with the broader Mars atmospheric community
  - commentary and issues/concerns raised
- Formulation of a workshop consensus minimum Charter
- Seeds for a White Paper on the MCMC

MCMC Workshop

- Held at the NASA Ames Research Center (ARC), Space Science and Astrobiology Division, 30 September – 2 October 2008 (2.5 days)
- Attended by $\mathcal{O}(60)$ members of the (US) Mars community: atmosphere & climate scientists; mission engineering support and planning personnel; high-end computing experts; NASA management (HQ, ARC & JPL); Mars 2013 SCOUT selection (*MAVEN*) Co-I
- *http://mcmcworkshop.arc.nasa.gov/agenda.html*

Workshop Themes

- Background, Current Modeling Status, Climate Issues (I)
- In Support of Missions: A/B, EDL, Lander Environments (II)
- New Mars Climate Modeling Frameworks and Further Enhancements (III)
- Regional Interfaces, Upward Expandability and High-End Computing (IV)
- Proposed MCMC Model (V)
- Breakout Discussion Groups (VI)
- Agency and Community Synthesis (VII)

Workshop Consensus Charter

- Develop and continuously improve a state-of-the-art Mars general circulation model (GCM)
- Support NASA Mars missions
- Engage the community by providing a framework for community access to the model and full documentation
- Generate and maintain a Mars climate database

White Paper

- Draft completed 22 January 2009
- Initial reviews by segments of the Community and NASA HQ (February 2009)
- Available for download at the MCMC Workshop webpage (after MEPAG #20)
  - *http://mcmcworkshop.arc.nasa.gov/read.html*
  - also from me via USB stick
- Additional Community comments are solicited
  - e-mail: *james.l.green@nasa.gov*
    michael.a.meyer@nasa.gov
    jeffery.l.hollingsworth@nasa.gov

Next Steps

- Finalize White Paper and submit to NASA PSD
- Assemble Science Advisory Group (SAG) to study MCMC concept and advise NASA HQ
- Establish *the* MCMC Charter
- Develop a schedule, milestones and budget
- Establish a MCMC Steering Committee (8–10 members)
- Draft Operational Plan in consult with Steering Committee

Summary

- As it is for the Earth, global climate modeling (3D) is an enormous enterprise which requires adequate resources and support
- NASA's MEP and the Community can benefit from a *standardized and realistically-supported* Mars climate modeling center that emphasizes service and that fundamentally promotes inclusiveness and cooperation
- In preparation for upcoming missions (MAVEN, 2016, . . .), the time for coordination within NASA's PSD and the Community is *now*

Extras

NASA/HQ Letter

National Aeronautics and
Space Administration

Headquarters
Washington, DC 20546-0001

June 10, 2008

Reply to Attn of: SMD/Planetary Science Division

Dr. Jeffrey L. Hollingsworth
Mail Stop 245-3
Ames Research Center
Moffett Field, CA 94035-1000

Dear Dr. Hollingsworth:

Following up on our recent conversations, this memo is my official request that Ames Research Center (ARC) organizes an exploratory workshop related to the establishment of a Mars Climate Modeling Center (MCMC) that would be based at the ARC. It is clear to me that ARC has the right mix of expertise, computing capability, existing Mars Global Circulation Model codes, and the desire to serve the community and better support the NASA Mars Exploration Program that makes this assignment easy for me to give to you. The objectives of the workshop should be to create a "White Paper" for a MCMC that would support Agency needs and science community goals. For example, I would expect these goals to include the development, documentation, integration and maintenance of an integrated suite of numerical models for the Mars climate system, from fully-coupled and integrated global climate models, as well as modular and "plug-compatible" routines. The governing principals for a MCMC would be to support our mission needs, to make the most of both current and future mission data, to improve modeling fidelity, to promote community access, and to facilitate future NASA plans for Mars both robotically and for human exploration purposes. Broad community participation is desirable so that this activity would benefit from all scientists who can contribute to this project and stimulate, foster, and enhance knowledge and cooperation in Mars global climate research.

Since it is essential to establish a community consensus on what needs to be done in order to fully utilize and extend the existing Mars climate models and best utilize the computing time at ARC that would be allocated to this project, please assemble a Science Organizing Committee (SOC) that represents the Mars climate community to bring this workshop to fruition. The SOC should include key Mars dust/atmospheric personnel from Goddard Space Flight Center and Langley Research Center. The SOC should choose speakers and set the agenda. I expect that one aspect of the workshop will be to explore how best to establish modular coding practices and portable climate models that are fully tested, documented and

maintained, which provides "user-friendly" open access. In addition, the workshop should explore how such an MCMC might efficiently operate, including a method for regularly obtaining community input to guide it once it is established. The committee and workshop attendees should be encouraged to also consider and describe other matters essential to the design or implementation of an effective MCMC.

The White Paper should be authored by the members of the SOC and would address, at the very least, the following: rational, organization, functions, and membership of the MCMC. In addition, the White Paper should also define roles and responsibilities of other Centers, as appropriate, since my expectation is that this will be a collaborative effort with ARC in the lead. I would expect this to be delivered to the Planetary Science Division within three months of the conclusion of the workshop.

Sincerely,

James L. Green
Director, Planetary Science Division

cc:
Dr. Edward J. Weiler, Associate Administrator for Science Mission Directorate, HQ
Dr. Simon P Worden, Center Director, ARC
Dr. Michael D Bicay, Director, Science Directorate, ARC
Dr. Timothy J. Lee, Chief, Space Science and Astrobiology Division, ARC

MCMC Consensus Charter

- Develop and continuously improve a state-of-the-art Mars GCM beginning with
  - NOAA/GFDL FMS dynamical core
  - ARC physics packages
- Support NASA missions
  - concept studies
  - operations
  - data interpretation

Workshop Goals

- Determine the
  - requirements of the community
  - range of climate models to be supported
  - desired products and deliverables
  - high-end computing (HEC) requirements
  - appropriate web-based interfaces
  - architecture of the MCMC
  - staffing requirements and budget needs of the MCMC